



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|---------------------|------------------|
| 10/789,083 | 02/27/2004 | Bang-Chein Ho | 252016-1710 | 7532 |
| 47390 | 7590 | 10/02/2006 | | EXAMINER |
| THOMAS, KAYDEN, HOSTEMEYER & RISLEY LLP 100 GALLERIA PARKWAY SUITE 1750 ATLANTA, GA 30339 | | | LE, DUNG ANH | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2818 | |

DATE MAILED: 10/02/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|------------------------|---------------------|--|
| Office Action Summary | Application No. | Applicant(s) | |
| | 10/789,083 | HO ET AL. | |
| | Examiner | Art Unit | |
| | DUNG A. LE | 2818 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 11 September 2006.
- 2a) This action is **FINAL**. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-15 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 11 September 2006 is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) Notice of References Cited (PTO-892)
- 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____

- 4) Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) Notice of Informal Patent Application (PTO-152)
- 6) Other: _____

Claim Rejections

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1- 7 are rejected under 35 USC 102 (b) as being anticipated by Okada et al. (6,514,860 B1).

Okada teaches a method of forming a dual damascene interconnect (3A-3M and related texts) in an integrated circuit comprising:

providing a substrate 110 (col 7, lines 20-21) having a first etched region 116 therein;

filling said first etched region 116 with a protective layer 148 (col 9, line 15-20); coating said protective layer 148 with a resist layer 150; patterning said resist layer 150 and said protective layer 148 to define an opening encompassing said first etched opening wherein said protective layer is recessed within said first etched opening (fig. 3H and related texts);

thereafter forming a second etched region 146 encompassing a top portion of said first etched region 116;
thereafter removing said resist layer 150 and said protective layer 148; and
thereafter filling said first and second etched regions 116/146 with a conductive material 122 to complete formation of said interconnect (figs. 3L-3M and related texts).

Regarding claim 2, wherein said protective material is a bottom antireflective coating (BARC) material (col 9, lines 15-20).

Regarding claim 3, wherein said BARC material has the following properties: it absorbs light at a wavelength (col 9, lines 20-25) used to expose said resist; it completely fills said first etched region; and it can be partially removed by a developer used to remove said resist (figs .3G- 3H and related texts).

Regarding claim 4, wherein said BARC material comprises polyimide or organic type ARC material (col 9, line 24).

Regarding claim 5, wherein said first etched region forms a via hole 116 and wherein said second etched region forms a trench 146 and wherein said via hole 116 and said trench together form a dual damascene opening (figs. 3I- 3J and related texts).

Regarding claim 6, wherein the said protective layer 148 recessed within said first etched region 116 has a height of between about 50% and 95% of a height of said first etched region (fig. 3G).

Regarding claim 7, wherein said first and second etched region are etched through an insulating layer 142/114 comprising silicon dioxide or low dielectric constant dielectric materials (col 8, line 26 and col 7, line 65).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 7 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Okada in view of Lee et al. (6861347 B2).

Okada disclosed the claimed invention as applied to claim 1 including a hard mask layer 117 overlying said insulating layer 142/114 prior to forming said first etched region except for hard mask layer comprises silicon nitride as cited in current claim.

Lee et al. teach the hard mask layer 308 comprises silicon nitride overlying said insulating layer prior to forming said first etched region (fig. 13, lines 50-55).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form the hard mask layer comprises silicon nitride overlying said insulating layer prior to forming said first etched region in Okada 's method, in order to simplify the process of creating the via hole because it has a low etching selectivity to insulating layer.

Set of claims 9-15

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 9- 14 are rejected under 35 USC 102 (b) as being anticipated by

Okada et al. (6,514,860 B1).

Okada teach a method of forming a dual damascene (figs. 3A-3M and related texts) interconnect in an integrated circuit comprising:
providing a substrate 110 (col 7, line 21) having a first etched region 116
11therein;

filling said first etched region with a bottom antireflective coating (BARC)
layer 148 (col 9, lines 15-20);

coating said BARC layer with a resist layer 150;
patterning said resist layer and said BARC layer to define an opening
encompassing said first etched opening wherein said BARC layer is recessed
within said first etched opening (3G-3H and related texts);

thereafter forming a second etched region 146 encompassing a top portion of
said first etched region 116;

thereafter removing said resist layer and said BARC layer (figs. 3H-3J and
related texts) ; and

thereafter filling said first and second etched regions with a conductive
material 122 to complete formation of said interconnect (fig. 3M and related
texts).

Regarding claim 10, wherein said BARC material has the following properties: it absorbs light at a wavelength used to expose said resist; it completely fills said first etched region; and it can be partially removed by a developer used to remove said resist (col 9, lines 15-25, fig. 3G-3H and related texts).

Regarding claim 11, wherein said BARC material comprises polyimide or organic type ARC material (col 9, lines 15-20).

Regarding claim 12, wherein said first etched region forms a via hole 116 and wherein said second etched region forms a trench 146 and wherein said via hole and said trench together form a dual damascene opening.

Regarding claim 13, wherein the said BARC layer 148 recessed within said first etched region has a height of between about 50% and 95% of a height of said first etched region (figs 3G-3H and related texts).

Regarding claim 14, wherein said first and second etched region are etched through an insulating layer 142/114 comprising silicon dioxide or low dielectric constant dielectric materials (col 8, line 26 and col 7, line 65).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 15 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Okada in view of Lee et al. (6861347 B2).

Okada disclosed the claimed invention as applied to claim 9 including a hard mask layer 117 overlying said insulating layer 142/114 prior to forming said first etched region except for hard mask layer comprises silicon nitride as cited in current claim.

Lee et al. teach the hard mask layer 308 comprises silicon nitride overlying said insulating layer prior to forming said first etched region (fig. 13, lines 50-55).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form the hard mask layer comprises silicon nitride overlying said insulating layer prior to forming said first etched region in Okada 's method, in order to simplify the process of creating the via hole because it has a low etching selectivity to insulating layer.

Response to Amendment

In claim1, Applicant(s) argues “Turning now to the substantive rejections, claims 1 and 9 stand rejected under 35 U.S.C.102(b) as allegedly anticipated by Okada et al (USPN 6,514,860 hereinafter “Okada”). Claims 1 and 9 are independent claims, from which claims 2-8 and 10-15 respectively depend. Applicant asserts that claims 1 and 9 are patentable for the reasons discussed below and, for at least the same reasons, claims 2-8 and 10-15 are also patentable.

The Office Action alleges that “Okada” discloses the method of forming a dual damascene interconnect in an integrated circuit as claims 1 and 9 recited. Applicant respectfully disagrees.

Claim 1 recites:

1 . A method of forming a dual damascene interconnect in an integrated circuit comprising:

providing a substrate having a first etched region therein;

filling said first etched region with a protective layer;
coating said protective layer with a resist layer;
patterning said resist layer and said protective layer to define an opening encompassing said first etched opening wherein said protective layer is recessed within said first etched opening;
thereafter forming a second etched region encompassing a top portion of said first etched region;
thereafter removing said resist layer and said protective layer; and
thereafter filling said first and second etched regions with a conductive material to complete formation of said interconnect.

(Emphasis Added). Claim 1 patently defines over the cited reference for at least the reason that Okada fails to disclose at least the features emphasized above.

As emphasized above, claim 1 defines a method of forming a dual damascene interconnect that comprises patterning the resist layer and the protective layer to define art opening encompassing the first etched opening.

In contrast, Okada teaches (in column 9, lines 44-49 and FIGS. 3G-3H):

“In one aspect of the invention, the organic fill material 148 can be removed using an oxidization process. The parameters of oxidization processes, also known as light ashing, are well known by those having ordinary skill in the art, and the invention is not limited as to particular process parameters.” The protective layer recited in claim 1 is patterned to define an opening. However, the organic till material 148 recited in “Okada”

is removed by ashing. "Ashing," however, is not a patterning process, as will be appreciated by persons skilled in the art."

In view of the following arguments. The Examiner respectfully disagree with the Applicant's position.

For claim 1, Applicant's arguments filed 9/11/2006 have been fully considered but they are not persuasive. Figures 3G-3H of "Okada" and related texts disclose that patterning said resist layer 150 and said protective layer 148 to define an opening encompassing said first etched opening wherein said protective layer is recessed within said first etched opening.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., The protective layer recited in claim 1 is patterned to define an opening. However, the organic till material 148 recited in "Okada" is removed by ashing. "Ashing," however, is not a patterning process, as will be appreciated by persons skilled in the art.) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Therefore, applicant's argument are not persuasive and the rejection is proper. For at least this reason, Okada does anticipate the embodiments of claim 1.

In claim 9, Applicant(s) argues:

9. A method of forming a dual damascene interconnect in an integrated circuit comprising:

providing a substrate having a first etched region therein;

filling said first etched region with a bottom antireflective coating (BARC) layer;

coating said BARC layer with a resist layer;

patterning said resist layer and said BARC layer to define an opening encompassing said first etched opening wherein said BARC layer is recessed within said first etched opening;

thereafter forming a second etched region encompassing a top portion of said first etched region;

thereafter removing said resist layer and said BARC layer; and thereafter filling said first and second etched regions with a conductive material to complete formation of said interconnect.

(Emphasis Added)

Like claim 1, claim 9 defines a method forming a dual damascene interconnect in an integrated circuit in claim 1 comprising patterning the resist layer and the BARC layer to define an opening encompassing the first etched opening. However, as noted above, the organic till material 148 disclosed in “Okada” is removed by ashing. Therefore,

reconsideration of the rejection of claim 9 is respectfully requested for at least the same reasons as claim 1.

In view of the following arguments. The Examiner respectfully disagree with the Applicant's position.

For claim 9, Applicant's arguments filed 9/11/2006 have been fully considered but they are not persuasive. Figures 3G-3H of "Okada" and related texts disclose that patterning said resist layer 150 and said protective layer 148 to define an opening encompassing said first etched opening wherein said protective layer is recessed within said first etched opening. Therefore, applicant's argument are not persuasive and the rejection is proper. For at least this reason, Okada does anticipate the embodiments of claim 9.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., The protective layer recited in claim 1 is patterned to define an opening. However, the organic till material 148 recited in "Okada" is removed by ashing. "Ashing," however, is not a patterning process, as will be appreciated by persons skilled in the art.) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Therefore, applicant's argument are not persuasive and the rejection is proper. For at least this reason, Okada does anticipate the embodiments of claim 9.

Hence it is believe that claims 1 and 9 are rejected over the cited reference (Okada et al). Insofar as claims 2-8 and 10-15 respectively depend from claim 1 and claim 9, these claims are also rejected at least by virtue of their dependency.

In claim 7, Applicant(s) argues: 'The Office Action also rejected claim 7 under 35 U.S.C. 103(a) as allegedly unpatentable over the combination of Okada in view of U.S. patent 6,86 1,347 to Lee. Applicant respectfully disagrees, for at least the reason that the Office Action failed to identify a proper suggestion or motivation to combine the select teachings from each of these two references. In combining these references, the Office Action stated only that the combination would have been obvious "in order to simplify the process of creating the via hole because it has a low etching selectivity to insulating layer" (Office Action, page 7). This alleged motivation is clearly improper in view of well-established Federal Circuit precedent.

It is well-settled law that in order to properly support an obviousness rejection under 35 U.S.C. 103, there must have been some teaching in the prior art to suggest to one skilled in the art that the claimed invention would have been obvious. *W. L. Gore & Associates. Inc. v. Garlock Thomas. Inc.*, 721 F.2d 1540, 1551 (Fed. Cir. 1983). More significantly,

"The consistent criteria for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this [invention] should be carried out and would have a reasonable likelihood of success, viewed in light of the prior art. ..." Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure... In determining whether such a suggestion can fairly be gleaned from the prior art, the full field of the invention must be considered; for the person of ordinary skill in the art is charged with knowledge of the entire body of technological literature, including that which might lead away from the claimed invention."

(Emphasis added) *In re Dow Chemical Company*, 837 F.2d 469, 473 (Fed. Cir. 1988).

In this regard, Applicant notes that there must not only be a suggestion to combine the functional or operational aspects of the combined references, but that the Federal Circuit also requires the prior art to suggest both the combination of elements and the structure resulting from the combination. Stiftuna v. Renishaw PLC, 945 Fed.2d 1 173 (Fed. Cir. 1991). Therefore, in order to sustain an obviousness rejection based upon a combination of any two or more prior art references, the prior art must properly suggest the desirability of combining the particular elements to derive a method of forming a dual damascene struture, as claimed by the Applicant.

When an obviousness determination is based on multiple prior art references, there must be a showing of some "teaching, suggestion, or reason" to combine the references. *Gambro Lundia AB v. Baxter Healthcare Corp.*, 110 F.3d 1573, 1579, 42 USPQZCI 1378, 1383 (Fed. Cir. 1997) (also noting that the "absence of such a suggestion to combine is dispositive in an obviousness determination").

Evidence of a suggestion, teaching, or motivation to combine prior art references may flow, inter alia, from the references themselves, the knowledge of one of ordinary skill in the art, or from the nature of the problem to be solved. See *In re Dembiczak*, 175 F.3d 994, 1000, 50 USPQZII 1614, 1617 (Fed. Cir. 1999). Although a reference need not expressly teach that the disclosure contained therein should be combined with another, the showing of combinability, in whatever form, must nevertheless be "clear and particular," *Dembiczak*, 175 F.3d at 999, 50 USPQZII at

If there was no motivation or suggestion to combine selective teachings from multiple prior art references, one of ordinary skill in the art would not have viewed the present invention as obvious. See *In re Dance*, 160 F.3d 1339, 1343, 48 USPQZCI 1635, 1637 (Fed. Cir. 1998); *Gnmbro Lundia AB*, 110 F.3d at 1579, 42 USPQZCI at 1383 ("The absence of such a suggestion to combine is dispositive in an obviousness determination.").

Significantly, where there is no apparent disadvantage present in a particular prior art reference, then generally there can be no motivation to combine the teaching of another reference with the particular prior art reference. *Winner Int'l Royalty Com. v. Wang* No 98-1553 (Fed. Cir. January 27, 2000). The rationales relied on by the Office Action in the present application are merely generic statements, that have nothing to do specifically with the structures disclosed in the other 'references. As such, these rationales cannot be properly viewed as proper motivations for combining the specific teachings of the individual references. Indeed, the genetic motivations advanced by the present Office

Action could be used to support a combination of ANY references, which is clearly contrary to the cited Federal Circuit precedent and the clear intent of 35 U.S.C. 103. For at least the additional reason that the Office Action failed to identify proper motivations or suggestions for combining the various references to properly support the rejections under 35 U.S.C. 103, those rejections should be withdrawn.

In view of the following arguments. The Examiner respectfully disagrees with the Applicant's position.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

In this case, **Regarding claims 7 and 15**, Okada disclosed the claimed invention as applied to claims 1 and 9 including a hard mask layer 117 overlying said insulating layer 142/114 prior to forming said first etched region except for hard mask layer comprises silicon nitride as cited in current claim.

Lee et al. teach the hard mask layer 308 comprises silicon nitride overlying said insulating layer prior to forming said first etched region (fig. 13, lines 50-55).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form the hard mask layer comprises silicon nitride overlying said insulating layer prior to forming said first etched region in Okada 's method, in order to simplify the process of creating the via hole because it has a low etching selectivity to insulating layer.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dung A. Le whose telephone number is (571) 272-1784. The examiner can normally be reached on Monday-Tuesday and Thursday 6:00am- 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571) 272-1907. The central fax phone numbers for the organization where this application or proceeding is assigned are (571)272-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DUNG A. LE
Primary Examiner
Art Unit 2818